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ABSTRACT

Experience with a number of teachers has shown that when they became aware of the uses of the categorizing processes, their teaching became more focused, they took account of student prior experience to a greater extent, and they allowed more time for students to practice the language needed to complete a task. A study was conducted to determine what three groups of middle school teachers knew about some aspects of the categorizing process and also to see how well they could write category labels for 10 very different sets of items. The three groups were sixth grade teachers, seventh and eighth grade language arts teachers, and science teachers from all three grades. A total of 84 teachers participated in the study. As might be expected, the science teachers scored significantly higher than the other two groups on the categorizing task. Surprisingly, however, they also scored significantly higher on the category labeling task, even though only one of the ten groups of items had anything to do with science and even though item analysis showed no pattern of item difficulty for any of the groups. Even more striking was the proportion of science teachers (43%) scoring above 60% on the labeling task as compared to the other two groups who were responsible for teaching language arts to middle school children. By the middle grades, language is an inextricable part of the grouping process by which people order information. If teachers themselves cannot produce good category labels, there is little hope that their students will learn how to use language to codify information and thus remember it, or recognize how others have done so. (FL)

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Thoughts on Teacher Thinking about Thinking

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INTRODUCTION

Understanding the structure of expository text is essential for comprehension. This structure is largely based on a hierarchy of groups of ideas with complex relationships between the groups. The subject matter of expository text from the middle school grades on up is often remote from the immediate experience of students. Their reasons for reading it are often not conducive to the forming of adequate mental representations of the task at hand. The subject-matter teachers are often quite unaware of the need for organizing assignments for maximum guidance. So how is the situation to be improved?

One possible way to help teachers understand and cope with the problems of expository text comprehension is to guide them towards understanding the most basic way in which people process information. They filter out myriads of sensory impressions which are not relevant to their needs and group those that are. This categorizing process is a basic biologically adaptive tool with which human beings make sense of experience, are able to learn from it by storing categories in memory, increase the efficiency with which they process new information, and are able to predict by observing patterns or common attributes. Since each person has a different set of experiences, each person also has different information stored as prior experience with which he or she must compare new data as it is encountered.

The categorizing process in its basic form is the same regardless of the information offered and that is one reason why a clear understanding and use of it can be a part of every class. First of all the information must come to the attention of a person which it will only do if it is relevant to a need or goal, such as survival, comfort, affection or respect. Once attended to, the information needs to be observed very carefully in order to be able to compare it to previous knowledge. Having observed at least the salient features of the proferred data, similarities and differences between this item and and others present in the environment or in memory are noted, and finally a generalization is formed or is recognized which expresses the common characteristic. As people in Western societies move up through the grades, language becomes a more and more important part of the categorizing process, naming experiences, naming important attributes, and expressing the label through which the item can be first stored in memory and then retrieved.

So what? So this ponderously described activity is a practical classroom tool which teachers can depend on over and over again. Once the game plan is understood, the processing of information can be seen in a different way and the need for giving opportunities from the early grades on up to carefully observe and discuss objects, words, concepts, and processes, compare with other items, note similarities and differences, and form precise generalizations about observed similarities, can be understood and acted upon. Were this to be done as a matter of course in the lower grades, using the great gift of categorizing which all human beings possess as a tool for processing expository text would be possible. Instead of single words, groups of ideas would be studied for their common bond, and several groups would be seen as related under a larger generalization. The signals or cues which direct the readers attention to the structure of ideas would be studied. These might be purely visual, such as headings in larger or darker letters, spacing, indenting, or listing, or they might be in the meaning of the heading or topic sentence, and within the relational or function words.

THE STUDY

The study to be briefly reviewed cannot be understood outside an information processing framework. Experience with a great many teachers over a period of years had indicated that their approach tended to be one of trying to "cover" the material, whatever that means. Many students were adrift, even when they wanted to learn the material. However, when teachers became aware of the uses of the categorizing process, their teaching became more focused, took account of student prior experience to a greater extent, and allowed more time for practising the language needed.

The exploratory study investigated what three groups of middle school teachers knew about some aspects of the categorizing process and also how well they could write category labels for ten very different sets of items. The three groups were sixth grade teachers, seventh and eighth grade language arts teachers, and science teachers from those grades. The groups were chosen by stratified random sampling of the total populations in a school district outside a large urban center. A total of 84 of the 100 teachers approached responded. This was 52% of the total population of those three classes of teachers. It was expected that the science teachers would know more about the categorizing process, but their ability to write category labels was not known.

The science teachers did score significantly higher than the other two groups of teachers on the questionnaire about the categorizing process. All of the variance was connected with the three items based on the following premise:

> There is a basic process by which human beings initially group experience, even if categorizing is completed in different ways according to stage of development or type of experience.

Unfortunately, the science teachers also scored significantly higher on the category labeling task, even though only one of the ten groups of items had anything to do with science and even though item analysis showed no pattern of item difficulty for any of the groups. Even more striking was the proportion of science teachers scoring above 60% on the labeling task as compared to the other two groups who were responsible for teaching language arts to middle school students. 43% of the science teachers, 21% of the seventh and eighth grade language arts teachers, and 16% of the sixth grade teachers were high scorers. (The attached page called "Category Labeling Results" and Figure 1 provide more information.)

IMPLICATIONS OF THE STUDY FOR TEACHER INFLUENCE ON STUDENT READING COMPREHENSION

Middle school classes have to be the place where students can acquire the necessary tools for processing increasingly abstract material in the upper grades. The most basic tool is the reasonable grouping of information according to common attributes. By the middle grades language is an inextricable part of this grouping process. It stands to reason that if teachers themselves cannot produce good category labels, there is little hope that their students will learn how to use language to codify information and therefore remember it, or recognize how others have done so.

It would be very helpful to us all if there were a number of studies done with different subjects under different conditions with different kinds of teachers to see in detail how helpful a concentration on categorizing might be in particular learning situations. However, the weight of basic research and logic coupled with the urgent need to prepare students today for the electronic age and the knowledge explosion would seem a more than adequate

reason for starting now with efforts to bridge the gap between what students do naturally in the world of daily living and what they are expected to do in the classroom.

Jerome Bruner and his colleagues provided basic research in A Study of Thinking (1956) and Studies in Cognitive Growth (1966). Taba actually trained fifth grade social studies teachers in using the categorizing process to raise the level of thinking (1965,1966, 1969). Klausmeier and his colleagues included the categorizing process in his studies (1974, 1978, 1980). Vygotsky, Piaget and Inhelder, Rosch, and Smith and Medin have all written extensively about various aspects of the grouping process. Lenneberg in Biological Foundations of Language (1967) has perhaps explained the role of language in adaptation to the environment best of all. This author has in a modest way also indicated reasons for studying and using the categorizing process in classrooms (1975,1981,1982, 1983, in press).

Recent work such as Papert's in Mind Storms and reviews of the relationship between technology and reading (Gerhard, 1984) indicate the need for training people to think inductively, or bottom-up. Fields of knowledge are changing so rapidly that the person who cannot analyze information for him or herself is going to be left behind. Teachers can hopefully learn to allow opportunities for students to observe and form generalizations on their own in the early grades so that they build up confidence in their ability to solve problems, to think in terms of probabilities and limitations.

A student who has learned to make use of his or her inate ability to categorize and acquire relevant language will surely have advantages when processing more complex and abstract expository text. Such skills as understanding the function of different parts of a book - introduction, table of contents, chapter headings, subtitles, or index - locating information in the library, picking out important information, outlining, summarizing and taking notes are also dependent on a knowledge of how and why items are grouped.

On a page of a textbook from middle school on there may be 300-800 words. If the student represents the comprehension task as processing these singly, the chances of improving comprehension are almost nothing. If, on the other hand, the page is seen as three or four groups of ideas to be processed, then attention can be focused on the relationships within and between the groups as signalled by particular language. The goal has to be understanding the structure on the page first, then its relationship to the rest of the text. Being allowed then to seek for ways in which the subject is related to individual prior experience offers a chance for real learning.

The study comparing science teachers to language arts teachers on the three middle school grade levels, if it can be generalized at all, would seem to indicate that the teachers responsible for providing the thinking and language tools needed in high school and later life have not been adequately trained for their task. While science teachers have guidelines provided for systematic categorizing or classifying, language arts teachers have more scope for comparing words, grammatical structures, characters in literature, forms of written language, areas in geography, cultures, and many other kinds of information. The teachers need first of all to mentally represent the process of careful observation, discussion, discovery of common attributes or characteristics, and the language needed for these and the forming of precise generalizations. They need to know that there are nearly always many logical ways of grouping information and that the nature of the task or goal determines which is most suitable at a particular moment.

Category Labeling Results (C)

Percentages of teachers in each group scoring high (over 60% correct) or low (under 40%)

	High Scores	Low Scores
Science (total n=23)	43%	17%
English (total n=24)	21%	29%
Sixth Grade (total n=37)	16%	35%

Even these percentages are less striking than a comparison of the best science teachers with the worst sixth grade teachers on the number of full marks for category labels written as shown in Figure 1. The following are two examples of these differences. For the given items

red
green
blue

a 3-point science teacher label was, "The primary colors." A 6th grade teacher produced, "Basic colors of your TV and how it work (sic)." For the list

flexible mechanical part
to jump
season of the year

a 3-point science teacher answer was, "Different meanings of the word spring." A sixth grade teacher wrote, "Necessary of track season." It should be added that an item difficulty study by groups of teachers revealed no pattern of any kind.

FIGURE 1

Differences in quality category labels (3 points) between the high scoring science teachers and low scoring sixth grade teachers

Subjects (n=10)	Item Numbers									
	1	2	3	4	5	6	7	8	9	10
High Scoring Science Teachers										
5.			X	X	X	X		X		X
6.		X								
11.		X		X		X				X
12.		X		X	X	X	X	X		
16.		X				X			X	X
17.	X	X		X	X	X		X		X
18.	X	X	X			X				X
19.	X	X			X		X	X		
20.				X	X	X				X
22.	X	X					X	X	X	
Low Scoring Sixth Grade Teachers (n=13)										
2.							X			
4.										
8.										
12.										
15.										
16.										
17.										X
22.										
27.							X			
28.										
32.										
34.										
37.										

High scorers defined as having scores over 60%
Low scorers defined as having scores below 40%

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